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ABSTRACT

A "communication system" paradigm for dissemination of appropriate knowledge, information, and technology needed for effective rural development is briefly described. The paradigm describes six categories of interrelated functions, activities, and processes: (1) scientific knowledge production by carrying out basic and applied research; (2) knowledge-management, where information is monitored, screened, indexed, catalogued, packaged, and stored in an accessible and retrievable form; (3) knowledge-translation, which synthesizes and converts scientific research into information useful to product-developers attempting to formulate solutions to practical problems; (4) product development, which combines scientific knowledge with knowledge of user needs, and develops products which have the potential of meeting those needs; (5) product-dissemination, which involves understanding the product and its uses, designing dissemination and communication strategy, distributing, adapting, and installing the product, and monitoring the product performance; and (6) product-adoption/utilization, by which users discover and diagnose problems, locate, try-test, adopt, and assimilate solutions into existing systems. A hypothetical example shows that a linear flow of knowledge information from basic research to the ultimate user need not be assumed in using the paradigm to improve dissemination of information for rural development. (JD)

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KNOWLEDGE GENERATION, ORGANIZATION DISSEMINATION AND UTILIZATION FOR RURAL DEVELOPMENT

George M. Beal**

The necessity of rural development as a high priority development goal is generally recognized, implicitly or explicitly, in most developing countries. The need for appropriate knowledge, information and technology to aid in that development is universally accepted. However, what is "appropriate" is heavily debated. Questions such as the following are raised: Appropriate from whose and what point of view, for what goals and with what consequences?

Much of the discussion of the use of knowledge for development is culturally or ideologically bound, fragmented, case specific, or role specific. It is recognized that each of these elements, and many others, are probably a part of any legitimate discussion in this area. However, it is possible that a more general level systems model of krowledge production, organization and dissemination and utilization might aid in providing a framework (even if only for heuristic purposes) within which more specific discussions, activities, research and studies, and reporting could be more meaningfully placed. This is not a new idea -- a number of "models" have been suggested. In this paper a summary of one systems model of knowledge utilization is presented. This model attempts to conceptualize (adapted from Meehan & Beal, 1977)

> a system in which knowledge is generated by scientists, clients and other system-participants and is systematically incorporated into the design, production, adaptation, dissemination and use of information, technology, products and programs to meet user needs.

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*This paper is heavily based on a previous paper, "The Role of Communication in Knowledge Production and Utilization," 9th World Congress at Sociology, Uppsala, Sweden, 1978.

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As stated above, a number of knowledge utilization models have been suggested. They vary from those relatively simple to those highly complex. The models also vary by level of abstraction and applicability. A number of criticims have been leveled at the various explicit and implicit models. Among those criticisms are (1) the assumption of linearity; knowledge flowing only from research, through technology to users (Gideonse, 1968) (Guba and Clark, 1975), (2) the major assumption of one way communication "down" through the system, largely authoritarian, persuasive or manipulative (Schutjer and Van Der Neen, 1976) (Wharton, 1969) (O'Kelley, 1977) (Cummings, 1977), (3) based on the above points the perception of the creation of dependency (rather than collaborative) relationships (Schumacher, 1973) (Roling, 1973) (Cummings, 1977) (Darling, 1977), (4) the assumption that only scientific research knowledge is relevant to problem solution (Havelock, 1969) (Handler, 1969) (Roling, 1973) (Hathaway, 1977) (Williams, 1978) (Beal and Meehan, 1978), (5) the assumption of technology <u>transfer</u> rather than an interactive communication process resulting in adaptive, intermediate or improved indigenous technology (Schumacher, 1973) (O'Kelley, 1977) (Gideonse, 1969) (Roling, 1973), (6) heavy responsibility placed on "linkers" without also placing responsibilities on those to be linked (Guba and Clark, 1975) (Gideonse, 1969) (Rogers and Jain, 1969) (Meehan and Beal, 1977), (7) dependence on "trickle-down" communication and lack of concern with the distribution effects of this type of technology adoption (Roling and Chege, 1976) (McNamara, 1977a) (Williams, 1978) (Ruttan, 1977) (Darling, 1977), (8) and probably most important, is the dissatisfaction with the effectiveness of many programs based on present information-communication systems

models. (Schumacher, 1973) (Wharton, 1977) (Cummings, 1977) (McNamara, 1977, a and b) (Williams, 1978) (Darling, 1977)

It is evident that each of these criticisms is deeply embedded in concerns with communications. The student of communication will immediately recognize the multitude of more specific communication issues inherent in these general criticisms.

It is only in the last two decades that emphasis has been placed on the systematic study and conceptualization of knowledge production and utilization communication systems. Some of the more recent research, conceptualization and communication system "model" building appear to counter some of the criticisms of past systems. One "communication system" paradigm is briefly described in this paper. It draws heavily on the work of many scholars, especially Havelock (1969) (1971) (1974), Guba (1970) (1974) and Clark (1975), Gideonse (1968), Rothman (1974), Kiehl (1970), Lionberger (1976), Coughenour (1976), Rogers (Rogers and Jain, 1969) (Rogers and Shoemaker, 1971) and Roling (1973) (Roling and Chege, 1976).

What follows is a brief discussion of what we have termed a paradigm which describes six categories of interrelated functions, activities and processes which are believed to be distinct enough to merit separate (stage or step) treatment, at least for heuristic purposes. While the importance of communicators and communication is evident throughout the paradigm they are not specifically emphasized. If the general paradigm has merit, it appears that a further elaboration of the importance, roles and dimensions of communication in the process is in order. In the basic

monograph presenting this paradigm (Meehan and Beal, 1977)* each stage is described more completely, and specific functions, activities, processes and products are described. A brief description will have to suffice here.

The six stages are thought to represent different sets of activities with different outputs and require different skills for the successful carrying out of the processes. The specialized activities are thought to represent elements of the knowledge-production-utilization structure which must be permeated by continual communication of each relevant stage is to contribute fully to the task of generating knowledge and making it functional and useful.

Although the ultimate user, in the product-adoption/utilization stage, is the ultimate target of communication and behavior change, actors in each stage must meet the needs of users in other stages (Gideonse, 1969) if the needs of the ultimate users are to be fulfilled. Each of the stages between research and adoption/utilization is regarded as knowledge production and utilization unit in itself. In each stage (as specified in the more detailed description of the paradigm) the actors are seen as beginning by identifying specific user needs, planning and producing outputs according to those needs, and packaging outputs to appeal to the specified clients (Gideonse, 1969).

The term product is used often in this description. It is used to apply to a broad range of phenomena including hardware, material and software "products"; e.g., a research report, an information search package, a brochure, a radio program, a feedback procedure, a training

*Peter M. Meehan and George M. Beal, Knowledge Production and Utilization: A General Model - Third Approximation, Sociology Report No. 138, Department of Sociology and Anthropology, Iowa State University, Ames, Iowa, 1977.

module, a family planning campaign, a newly created advisory committee, an interorganizational coordination council with negotiated authority.

A brief description of the six stages follows.

1. Scientific knowledge production. Scientists, using the scientific method, produce knowledge in the form of verified statements of relationships between and among variables. Scientific knowledge is produced primarily by carrying out basic and applied research. Though the distinction made between basic and applied research is not always clear, they can be seen as semi-autonomous but in many cases complementary activities which often must be interrelated or linked to provide information related to user needs. Basic research is often seen as oriented toward the production of knowledge for knowledge or discipline sake, while applied research is seen as producing or applying knowledge for solution of "real world" problems. Both types of knowledge may be needed to provide full or partial information to define or suggest possible solutions for user problems or for the development of technology.

I

KNOWLEDGE-PRODUCTION

Basic Research (BR)	Applied Research (AR)
1. depict problem	1. identify user needs
2. review research	2. depict problem
3. relate variables	3. review research
4. conceptualize problem	4. relate variables
5. test hypotheses	5. conceptualize problem
6. conclude from tests	6. test hypotheses
7. package results	7. conclude from tests
8. communicate results	8. package results
9. evaluate method	9. communicate results
	10. evaluate method

2. Knowledge-Management. The main outputs of the knowledge-production stage (previous stage) is a vast array of articles, reports, papers, monographs and books presenting research findings. If this knowledge is to be effectively utilized it must be monitored, screened, indexed, catalogued, packaged and stored in a form which is readily retrievable at access points for functional search, use and dissemination. These activities may be designated as knowledge-management.

II

KNOWLEDGE-MANAGEMENT

1. identify user needs
2. monitor/screen research
3. catalogue
4. package
5. store
6. disseminate
7. evaluate operations

3. Knowledge-Translation. Knowledge-translation involves the synthesis and conversion of scientific research findings into information useful to product-developers who attempt to formulate solutions to practical problems. This stage may be characterized as one of the specific "meeting points" of abstract, scientific knowledge with the practical knowledge and problem definitions of clients. Effective "meeting" usually takes place through the efforts of highly-skilled translators or linkers with a "dual understanding" of the scientific and practical conception of the same problem--possessing the skills to code and recode back and forth between the client's formulation of a problem and relevant descriptors

of available scientific knowledge. Scientific research is synthesized, generalized and operationalized to bear on the problems of clients and alternative products which may aid in problem solution. The outputs from this stage may be papers, reports, presentations or consultation containing guidelines and information highly relevant for product development.

III

KNOWLEDGE-TRANSLATION

1. identify user needs
2. recode user problem
3. review research
4. synthesize/generalize research
5. recode generalizations
6. operationalize
7. package
8. disseminate
9. evaluate operations

4. Product Development. At the product development stage translated (synthesized, generalized and operationalized) scientific knowledge is combined with knowledge of user needs (existing or created) and "products" are developed which are judged will have the potential of meeting these needs. There are variations in the orientations to product development: on the one hand there is emphasis on discovering needs and wants of target audiences (often involving disseminators and linkers in this process) and developing goods and services to meet these needs; on the other hand, the product may be first developed then its use is "promoted."

Solutions ("products") may take the form of social or material technologies--software or hardware.

IV

PRODUCT-DEVELOPMENT

1. identify user needs
2. formulate problem
   a. review research
   b. investigate user-system
   c. relate variables
3. invent solution
   a. draft performance/appeal specifications
   b. determine general function
   c. invent/design alternative solutions
   d. analyze/assess solutions
   e. select optimal solution
   f. design prototype
   g. review prototype
4. fabricate prototype solution
5. test, re-test prototype
6. fabricate marketable solution
7. package solution
8. transfer to disseminators
9. evaluate operations

5. Product-Dissemination. Once potential solutions to user needs or problems (existing or created) are developed dissemination to clients or users is undertaken.

Activities at this stage usually include understanding the product and its uses, designing dissemination and communication strategy, distribution of the product, adaptation and installation of products, and monitoring product performance.

V

PRODUCT-DISSEMINATION

1. identify user needs
2. communicate needs to developer
3. assist product-development
4. understand solution
5. design dissemination/ distribution strategy
6. communicate product messages
   - advertise
   - publicize
   - promote
   - demonstrate
   - consult
   - counsel
   - inform
   - sell
7. initiate distribution
8. adapt/install product
9. monitor product performance
   - service
   - repair
   - resell
   - replace
10. evaluate operations

6. Product-Adoption/Utilization. Product-adoption/utilization is the process by which users, discover and diagnose problems, locate solutions, try-test solutions, adopt solutions and assimilate solutions into their existing systems in a manner to secure effective utilization of the solution.

VI

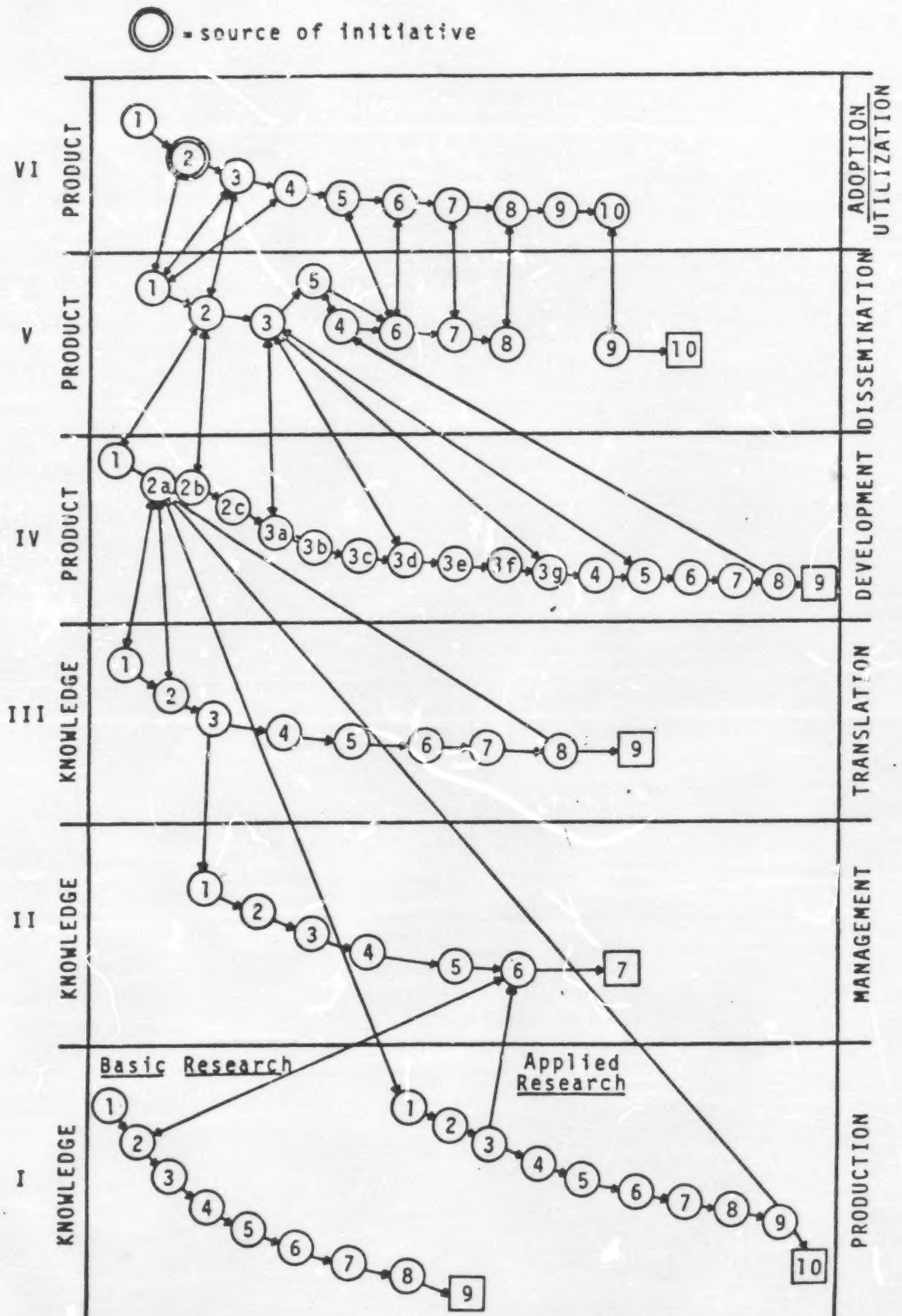
PRODUCT-ADOPTION/UTILIZATION

1. live with current needs
2. discover problem
3. diagnose problem
4. search for solution
5. evince interest in solution
6. try-test
7. adopt (or not adopt) solution
8. adopt/install solution
9. institutionalize solution
10. evaluate solution-maintain/ repair/replace

In some cases solutions to user needs or problems may already be available. The model argues for this situation setting off an interactive communication process that will continue through the previously discussed stages until knowledge sufficient to solve the problem is found or generated and the knowledge is transformed into a solution which is packaged and communicated to relevant linkers until the ultimate user can test, adapt and incorporate it into his situation for effective utilization. Thus, the paradigm may have the appearance of being one-way, linear—this is not necessarily true.

To further illustrate this point, a hypothetical example is presented. See the flow diagram on the next page labeled, "An Iterative, Dynamic Model of Knowledge-Production-and-Utilization in Agriculture."

The source of initiative for this particular path of utilization is the farmer in Stage VI who lives with his/her current needs (Stage VI, step 1) for fertilizers, pesticides, on and then discovers a problem (Stage VI, step 2). The problem is that current pesticides do not control a certain insect; as a result the corn-yield has been reduced significantly. The farmer and a technical field representative of a pesticide firm discuss the problem and they identify the farmer's need (Stage V, step 1). Farmer and representative then jointly diagnose the problem (Stage VI, step 3). The field representative (perhaps with an extension agent) communicates this need to a product-developer (Stage V, step 2) in a pesticide firm who thereby identifies the problem (Stage IV, step 1) and sets out to formulate the problem by means of a research review of corn pesticides and further investigation of the social and physical environmental problems of the farmer (Stage IV, step 2a and b). In doing so, the developer contacts a knowledge-translator to generate a synthesized, generalized, and operationalized packet of knowledge on the corn pest problem (Stage III, steps 1-8). Much of this knowledge is received from knowledge-management services through designation of appropriate descriptors (Stage II, steps 1-6). However, certain questions remains unanswered and the developer calls upon applied social and physical scientists to conduct experiments which clarify the operation of variables causing the farmer's problem (Stage I, (AR) Steps 1-9). In their literature reviews (Stage I, (AR) Step 3), the applied researchers utilize basic scientific knowledge retrieved, catalogued, and stored by a nationwide agricultural information-management service similar to that described by Kiehl (1970) (Stage II, steps 1-6). This knowledge was gathered over time from basic research projects in chemistry, economics, sociology, entomology, and other sciences (Stage I (BR) steps 1-8).



An Iterative, Dynamic Model of Knowledge-Production-and-Utilization in Agriculture 13

The applied researcher reviews this research, conducts experiments in the laboratory and the field, and the packages, translates and communicates the results (Stage 1, (AR) steps 8 & 9) to the product-developer to assist in problem-formulation. With sufficient empirical and theoretical knowledge of relevant variables, the developer begins the extended process of invention (Stage IV, step 3 a-g). At this point (with sufficient knowledge produced and communicated to the developer), interaction on the knowledge-production-and-utilization chain shifts decidedly to product-development, dissemination, and adoption/utilization (Stages IV-VII).

During invention, extension agents and field representatives assist wherever necessary in the drafting of performance and appeal specifications (Stage IV, step 3a), analysis and assessment (Stage IV, step 3d), and final review (Stage IV, step 3g). Disseminators as well as a sample of potential users further assist in field-testing (Stage IV, step 5). At the same time, agents and marketing specialists begin to plan alternative dissemination and distribution strategies according to place, price, product, and promotion variables (Stage V, step 5). When the product if finally deemed market-ready, it is fabricated (Stage IV, step 6), packaged with instructions and an appealing appearance (Stage IV, Step 7), and transferred to disseminators (Stage IV, step 8). Agents and salesmen study and learn about the use of the product until they understand the product (Stage V, Step 4): and, if necessary, they revise and implement the previously-designed dissemination/distribution strategy. Implementation occurs when product-messages are communicated to farmers through advertising, promotions, demonstrations, consultation, and selling (Stage V, step 6). This is likely to involve a variety of personal and impersonal contacts with farmers over an extended period of time. Disseminators may encourage try-tests or even include

free try-tests of the product in their dissemination/demonstration package (Stage VI, step 6). Farmers begin to purchase the new pesticide through conveniently-located sales points in the distribution channels (Stage V, step 7). Agents and salesmen assist farmers in the final adaptation and installation of the pesticide in their particular farming systems (Stage V, step 8 and Stage VI, step 8). Based on continued need and satisfactory product-performance, the new pesticide is repurchased and finally institutionalized by farmers over time (Stage VI, step 9). Farmers evaluate the product while agents and salesmen monitor its performance and action is taken by disseminators and users over the years to improve and perhaps eventually replace the pesticide with a better one (Stage V, step 9 and Stage VI, step 10).

An entire cycle of knowledge-production-and-utilization has been completed to illustrate the possible interaction of steps and stages on the utilization chain. In this case, initiative came from the client; knowledge-information was channeled through dissemination, development, translation, management, and production stages; and then came back to the client in the form of a solution to the original problem--a corn pesticide.

A Final Note

The production and utilization of knowledge for the solution of individual and social problems is seen as a complicated, interactive, iterative process involving a number of different "stages," roles, functions, activities, opportunities and constraints. Effective communication is at the heart of the process if relevant knowledge is to be generated, made available, integrated, adapted, packaged, disseminated and used.

The knowledge-production-utilization paradigm presented here attempts to take into account the various types of knowledge and sources of knowledge probably needed for problem definition and solution. It does not assume a linear flow of knowledge-information from basic research to the ultimate user. It recognizes that initiative and initiation of the communication process can start and/or occur at any stage of the paradigm. There is a recognition that the process is iterative in character and that knowledge and communication flows back and forth within and among stages--the process is often marked with repetition and recurring interaction.

Emphasis is placed on knowledge management, knowledge translation and the availability and use of relevant knowledge in "product" development. The need was pointed out for highly-skilled translators or linkers with the dual understanding of the scientific and practical conception of the same problem--possessing the skills to code and recode back and forth between the clients for mutation of a problem and relevant descriptors of available scientific knowledge. Whether this role is performed by a more highly trained specialized linker or communicator, or by improving the conceptual and communicative skills of those now found in these roles is not clear.

It may be noted that each stage in the paradigm can be seen as a miniature knowledge need definition, production, packaging and dissemination activity. That is, concern with immediate (not only ultimate) client needs, preparing and packaging information-products understandably and with appeal, attention to dissemination communication strategies, and helping test and secure utilization of the "product" are seen as important functions <u>at every stage</u> -- not just in relation to the ultimate client or user.

The paradigm provides the opportunity for the involvement of ultimate users and intermediate linkers and their knowledge, conceptual and communication contributions in defining problems, formulating and adapting solutions, and integrating them into existing systems of actions. It allows for collaborative knowledge production and utilization, a move away from dependency relations and could facilitate more equitable distribution of benefits. Thus knowledge of various kinds, communicated from various sources should contribute to the development of intermediate technology, appropriate technology, selective technology, and adaptive research, development and trials which will be more effective in the solution of individual and social problems.

The paradigm calls not only for a revised conceptualization, but in many cases for changes in philosophy and the development of new functions, roles and responsibilities -- communicators are probably among those most affected.

The short-run utility of this paradigm rests on further discussion and clarification of its content and intent and field testing in real world knowledge-production-utilization situations under different conditions. We hope it will be subjected to these evaluations soon.

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